ERM-Southwest, inc.

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February 2, 1989

Mr. Brent Truskowski
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

W.O. #92-04

Subject: Construction Procedures Utilized During Final Phase I Monitor Well Installation at the Arkwood, Inc. Site, Omaha, Arkansas

Dear Mr. Truskowski:

Phase I monitor well installation at the above referenced site was completed on Monday, January 23, 1989. Some of the procedures utilized represented changes from the originally proposed installation procedures discussed in the December 27, 1988 and January 4, 1989 letters detailing proposed well locations and construction methods. These changes are as follows:

1. Rather than locating the three Compton wells as shown in Figure 1 of the January 4 letter, three alternate locations were selected and agreed upon in the field by you, Ruth Izraeli, Dan MacLemore and Emilio deCardenas (See Figure 1).

2. Two of the wells, MW-1 and MW-3, encountered clay filled cavities within the zones to be monitored. It was originally proposed that such situations would be handled by reaming out the holes and installing 4-inch galvanized steel screen and casing using standard well completion techniques. However, the initial attempt at reaming out MW-1 resulted in a severely deviated hole. It was felt that a combination of the deviated hole and relatively thick sequence of very soft clay infilling the cavity would make it difficult, if not impossible, to install a 4-inch well with a satisfactory sand pack. It was therefore decided to use 2-inch well screen and casing since it could be installed through the smaller hollow-stem augers. However, there was still a concern about obtaining a satisfactory sand pack. This concern was addressed by using a double walled, fiberglass reinforced epoxy, 10-slot screen (2" I.D. and 3" O.D.) with a 20-40 sand pack built into the annulus between the two screens.

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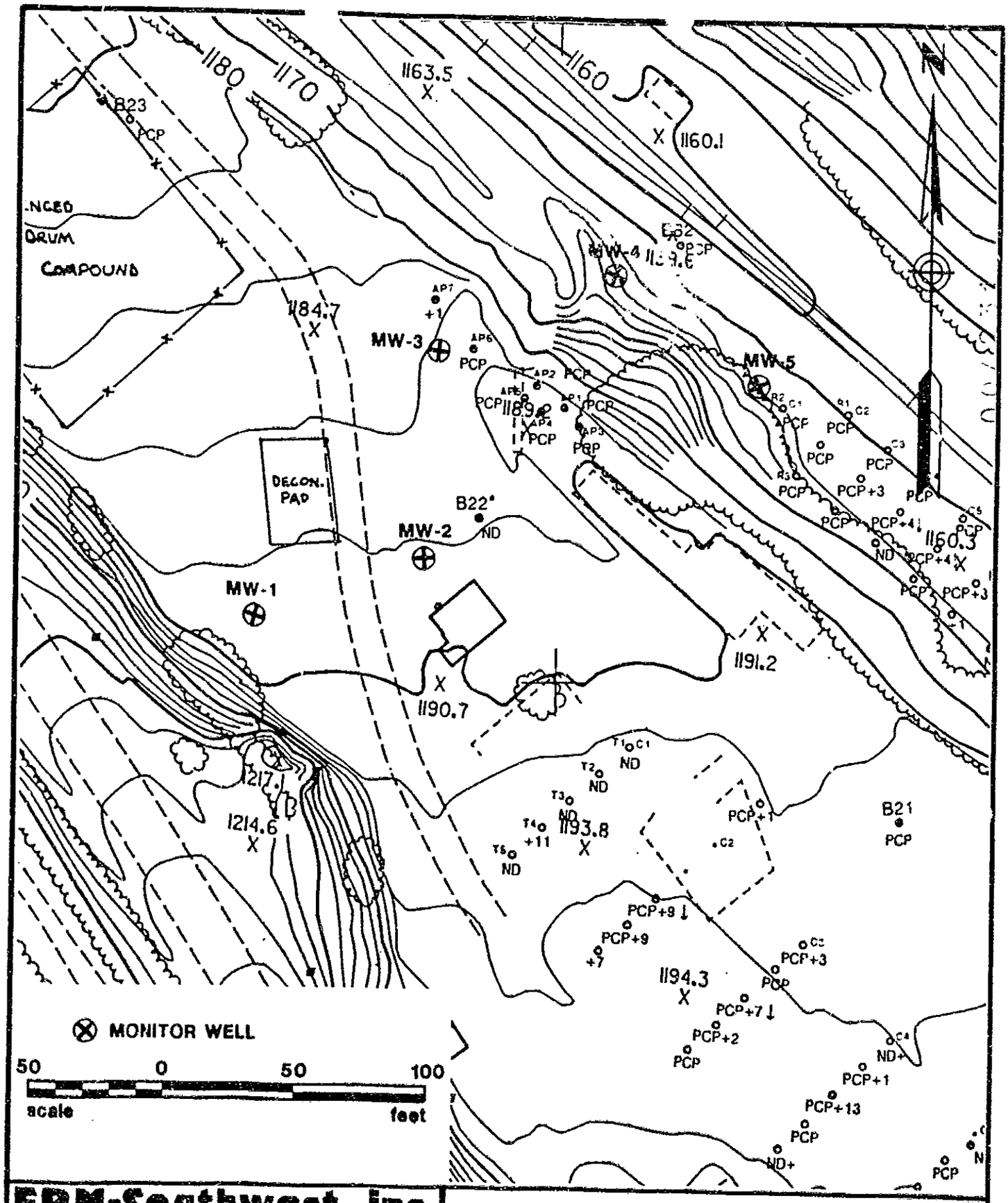

ERM-Southwest, Inc.
NEW ORLEANS, LOUISIANA — HOUSTON, TEXAS

DATE 1/27/89	W.O.NO. 9204A004

FIGURE 1

APPROXIMATE MONITOR WELL LOCATIONS

ARKWOOD, INC. SITE
OMAHA, ARKANSAS

Attachment 1 is a portion of a technical document describing the physical and chemical qualities of fiberglass reinforced epoxy, well construction material. After obtaining oral approval from you and Dan MacLemore, this material was used for MW-1.

3. In view of the difficulty encountered in reaming MW-1, it was decided to eliminate this step in the construction of MW-3 and immediately go to a 2-inch well. However, it was felt that a good sand pack could be installed and that a double walled screen was not necessary. Since steel well construction materials were originally suggested, it was decided to stay with steel. Because of the flush joint design and small price differential, the decision was made to upgrade from galvanized steel to stainless steel for this well. Oral approval from you and Dan MacLemore was again obtained prior to implementing the alternate well design for MW-3.

The alternate Compton well locations and alternate well construction materials represent the only changes to the originally proposed procedures. If you have any questions, please contact Steve Calhoun or me.

Sincerely,

ERM-SOUTHWEST, INC.

Richard H. Fuller

Richard H. Fuller, P.G.
Principal

RHF/kcm:1442
Attachment

cc: Bob Barker, Mass Merchandisers, Inc.
Robert Ritchie, McKesson Corporation
Jean Mescher, McKesson Corporation
Dinah Darman, McKesson Corporation
Dan MacLemore, Weston
Douglas Diehl, ERM-Southwest, Inc.
Steve Calhoun, ERM-Southwest, Inc.

ENCO.EMC

ATTACHMENT 1

FIBERGLASS REINFORCED EPOXY WELL CASING AND SCREENS

HISTORY

Fiberglass piping systems have been used successfully in industrial, oil and mining applications for over 35 years, primarily in hostile environments, due to their ability to withstand attack by caustics, acids and other corrosive materials. Long respected in these industries, they were not used in the environmental industry until the early 1980's when serious questions arose, throughout the environmental industry, concerning the reliability of field materials, sampling methods and equipment. Due to the rapidly decreasing detection limits available to the laboratories, the data coming from the field was becoming increasingly suspect in many instances of "shadow contaminant" occurances.

This being the case, there was an increasing amount of research conducted in well casing materials.

Many casing materials in use at that time had been conclusively determined to leach or absorb unacceptable amounts of inorganic and organic chemicals. Fiberglass reinforced epoxy casing was investigated extensively due to its 75% glass content, the closed molecular structure of epoxy, the strength, longevity and lack of brittleness.

The results of extensive testing of this product led to a wide acceptance for the use of this casing as an alternative to PVC, TEFLON, and STAINLESS STEEL.

Fiberglass Reinforced Epoxy casing has now been installed in every E.P.A. region over 2000 times, resulting in over fourteen quarters of consecutive pollution plume sampling with no adverse reports or interpretational difficulties. In fact, the casing and screen has far surpassed all expectations for rigid environmental specifications.

OVERVIEW

In this technical document, we present detailed descriptions of the physical and chemical qualities of **Fiberglass Reinforced Epoxy** monitor well casing and screens, including the extensive testing protocol and test results.

There are several different types of fiberglass casing and piping materials on the market today, so it is important to differentiate between the product that is outlined in this document and the other available products.

ENCO produces and markets the ***only*** fully tested, inert casing material available. This F.R.E. casing pipe stock is manufactured by only one company and is protected under U.S. and foreign patent laws. The entire down-hole assembly is made of high purity epoxy with a proprietary HP hardener and continuous filament silica glass reinforcing, providing both the very high strengths characteristic of composite structural materials and the desirable, single chemical assemblage.

The Ratio of Silica Glass to Epoxy is 75 / 25

It is unsuitable to use the amine or plastic resin materials, as the absorbance of organics is extremely high, as is typical of most thermoplastics.

ENCO casing and screen products contain only fully reacted, epoxy resins and contain no plasticizers, glues or products containing any organic groups which appear on the E.P.A. priority pollution list. In fact, our products are intrinsically incapable of leaching any priority pollutants.

FIBERGLASS REINFORCED EPOXY CASING AND WELL SCREENS

TECHNICAL ADVANTAGES

INERT QUALITIES	Constructed of 75% High Silica glass and 25% High Purity, Closed Molecular Epoxy. Certified, *Tested 100% Inert.* Product will not compromise the groundwater sample.
LOWEST SORPTION	Proven the lowest sorption of any tested product. Calculated $^1/_{17}$th sorption rate of Teflon.
FULLY TESTED	Most stringent testing protocol of any product to date. Short and long term leach tests show no Priority Pollutant leach out. Minimum time to sorption stabilization.
SUPERIOR PHYSICAL DESIGNS	Include hi-bond outer surface for positive annular seal, bacteriostatic inner surface, integral couplings with O-ring seal. Oversized inner diameter for equipment passage. High strength, low weight.
ENGINEERED ASSEMBLIES	No waste, no expensive pup-joint inventory. Individually designed, custom slotted assemblies bundled and marked by well numbers.
RAPID INSTALLATIONS	No field make-up requirements, all components factory assembled. Minimal rig time ready, reducing on-site costs.
FULL RANGE OF SIZES	2.2, 3.0, 4.3 and 6.5 inch internal diameters up to 36" available.
PRECISION SLOTTING	Virtually any slot configuration available at sizes as low as .010". Up to15% open area achievable.
HYDROPHYLIC	High flow rates with no down hole deformities.
SUPERIOR QUALITY	Four point inspection process ensures top quality. Guarantee screens and casings delivered on-spec and on-time.

ENCO Casing and Well Screens are impervious to gasoline, hydrocarbon products and most associated solvents and additives.

They can be used in the most sensitive groundwater investigations with full confidence in their integrity and ability to perform.

PRODUCT SUITABILITY

ENCO Well Casing and Screens are specifically of use in the following areas:

UNDERGROUND STORAGE FACILITIES

Leak Detection Systems:

ENCO Casing and Well Screens are impervious to all components of gasoline, hydrocarbon products and most associated solvents.

This casing will remove all suspect materials from the construction of your monitor wells at considerably less cost than either Stainless Steel or Teflon.

Shallow wells around underground tanks can be supplied in one piece with any slot configuration at any desired interval. Drive points are available which can be hammered or vibrated into soft backfill areas.

ENCO can supply Chemical Resistance charts covering most organic and inorganic chemicals and their effect on casing and handling systems.

Product Recovery Systems:

All 2" and 4" nominal size Well Casings and Screens have an oversized inner diameter that is mirror smooth to facilitate access of detection probes and recovery pumps in the same well without removal.

All casing sizes may be completed below grade and completed with an N.P.T. standard fitting (factory installation available) to allow the use of standard underground vault systems.

Sensitive PPB Monitor Wells:

ENCO Monitor Well Casings and Screens are <u>100% INERT</u>. They will not leach any priority pollutants into the groundwater. This has been proven in a multitude of tests. All tests were designated by Region 8 E.P.A. personnel, resulting in their use in sensitive monitoring applications.

ENCO will supply *Custom Well Assemblies* to the client's specifications or our screens are avaialble in stock 5', 10', 20' and 30' lengths, with either male and female integral, tapered couplings or a factory installed bottom cap.

Our entire line of Well Casings and Screens are designed to be *Chemically Inert* as well as *Cost-Effective* in both material cost and installation cost. All well components are shipped complete - there are no field make-up requirements, no gluing, welding or field dressing are necessary.

SYNOPSIS OF PHYSICAL CHARACTERISTICS AND TESTING PROTOCOL

ENCO FIBERGLASS REINFORCED EPOXY CASING AND SCREENS

All downhole assemblies are manufactured using a priority formula comprised of an **HP Anhydride Epoxy** and a **High Silica Filament Glass.**

The continuous filament gives the product an extremely high strength / weight ratio, far exceding any comparable material.

The glass to epoxy ratio is 75% glass to 25% epoxy, resulting in the desired composite material of virtually indestructible glass, sheathed in a closed molecular epoxy.

From the viewpoint of the Environmental Industry, this has become an extremely valuable product, desired both for its chemically inert structure and its low cost.

There are several different types of Fiberglass casing and pipe materials on the market, so it is important to differentiate between **ENCO** products and others. **ENCO** produces and markets the **ONLY** *fully tested, inert material available.*

This F.R.E. casing and screen stock is manufactured by only one company and is fully protected under U.S. and foreign patent laws. All other Fiberglass systems are manufactured with a vinyl ester, plastic or untested epoxy resin material. Most of these materials are capable of high absorbance or leaching of priority pollutants.

ENCO Products are Intrinsically Incapable of Leaching any Priority Pollutants.

PHYSICAL DESCRIPTION

SIZE	INSIDE DIAMETER	OUTSIDE DIAMETER	COUPLING DIAMETER	INTERNAL OPERATING PRESSURE (PSI)	EXTERNAL COLLAPSE (PSI)
2" Casing	2.23"	2.35"	3.12"	450	230
2" Screen	2.23"	2.39"	3.12"	800	550
3" Casing	3.35"	3.49"	4.33"	450	160
3" Screen	3.35"	3.57"	4.49"	800	550
4" Casing	4.33"	4.49"	5.58"	450	150
4" Screen	4.33"	4.62"	5.78"	800	480

1) **Service Temperature** .....200°F
2) **Weight Per 100'** .....2" - 50.0; 3" - 77.0; 4" - 100.0
3) **Mill Test Pressure** .....1.25 X Operating Pressure
4) **Higher Test Wall Thicknesses available up to 4000 psi External Collapse and 4000 psi Internal Operating Pressure**
5) **pH Range** .....1.5 to 11

TESTING SUMMARY

The following Sorption and Leaching tests have been carried out on production run samples of ENCO F.R.E. casing materials. An independent, E.P.A. approved laboratory performed all tests. Detection limits were in accordance with current E.P.A. Priority Pollutant standards or below.

All tests were carried out on either ground up material for maximum sensitivity, fractured casing to simulate slotted sections, or two foot casing samples which included a threaded joint and O-ring seal.

<u>All tests confirmed the theoretical inert qualities of this casing.</u>

1. 72 hour leach tests using fractured material, in carbon filterer de-ionized water carrying 700 µg/l of solvents and Halogenated Organics.

   RESULTS: no extraneous compounds on the GC/MS chromatogram and no increase of the seven solvents occurred.

2. Leach tests on ground F.R.E casing using carbon filtered De-Ionized water, 72 and 504 hours.

   RESULTS: Leachates subjected to full Priority Pollutant analysis showed zero leaching.

3. Leach tests using sample lenghts of F.R.E. casing including a joint with an O-ring seal for 504 hours.

   RESULTS: No Priority Pollutants found in the leachate.

4. Absorbance (Sorption) tests using water doped with 700 µg/l of four Halogenated Organics and three solvent organics.

   RESULTS In 72 hour tests, F.R.E. casing performed better than one hour tests using Teflon laboratory tubing. It has been calculated that F.R.E. casing will reach sorption equilibrium in 15 days compared to 330 days for Teflon and other Thermoplastics.

(Analytical Procedures conformed with appropriate E.P.A. methods 608, 610, 612, 622, 624 and 625.)

The objective of the tests was to determine if any Volatile Organics, selected from compounds commonly found in Hazardous Waste sites, would be absorbed by the F.R.E. casing from an aqueous solution, using concentrations of organics comparable with those experienced in pollution plume surveys. Simulation of monitor well casing conditions was sought by testing fractured pieces, exposing the inner structure of the casing as with machined slots.

The test protocol followed recommendations of the Colorado Department of Health, Region 8 E.P.A., and the City and County of Denver.

All tests were performed by Rocky Mountain Analytical Laboratory, Arvada, Colorado.